

Message Text

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SUBJECT: FAST REACTOR PROGRAM FUEL DEVELOPMENT

FOR RD&T/NEMZEK FROM SCIATT/HUDSON

1. PER NEMZEK-HUDSON TELECON JANUARY 8, THIS MESSAGE SUMMARIZES CURRENT STATE CANADIAN CARBIDE FUEL WORK AND POSSIBILITIES FOR RENEWED USAEC/AECL COOPERATION. PLEASE NOTE MESSAGE CONTAINS INFORMATION MADE AVAILABLE BY AECL ON A PRIVILEGED BASIS FOR USE OF USAEC ONLY.

2. WITH DIMINISHED CONTACT BETWEEN CANADIAN AND AMERICAN ATOMIC ENERGY PROGRAMS RESULTING FROM DIVERGING DIRECTIONS TAKEN BY THE TWO PROGRAMS BEGINNING IN LATE 1966, THERE HAS BEEN ALMOST NO RECENT CONTACT ON SUBJECT OF CARBIDE FUEL. LAST SUBSTANTIVE CONTACT WAS AT POINT OF TERMINATION OF OLD COOPERATIVE HWOCR PROGRAM IN LATE 1967-EARLY 1968. CANADIANS HAVE MADE VERY SUBSTANTIAL PROGRESS IN IMPROVING AND DEVELOPING URANIUM CARBIDE FUELS SINCE THAT TIME. PRIMARY AIM OF CANADIAN PROGRAM WAS, OF COURSE, TO PROVIDE HIGH PERFORMANCE FUEL FOR HWOCR PROGRAM. NEVERTHELESS, MANY OF THEIR DEVELOPMENTS WOULD BE DIRECTLY APPLICABLE TO ADAPTATION OF CARBIDE FUELS FOR FAST BREEDER USE. ON BASIS INFORMATION AVAILABLE HERE, AECL BELIEVES IT IS CURRENTLY PROBABLY THE POSSESSOR OF MOST ADVANCED

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UC TECHNOLOGY IN THE WORLD AND INDEPENDENTLY WE ARE INCLINED

TO CONCUR.

EM REFERENCE FUEL FOR PROPOSED CANADIAN HWOCR WHICH WAS CONSIDERED PROVEN OR PROVABLE ON PROTOTYPE TIME SCALE WAS 18-ELEMENT NATURAL URANIUM CARBIDE, CLAD IN ZIRCONIUM WITH 2.5 PERCENT NIOBIUM. UC FUEL WAS SLIGHTLY HYPERSTOICHIOMETRIC, I.E., 4.8 TO 5.2 PERCENT CARBON, ARC CAST SLUGS GROUND TO SIZE. NOMINAL BUNDLE DIAMETER WAS 102 MM, LENGTH 500 MM., INTERELEMENT SPACING 1.25 MM., ELEMENT DIAMETER 19.4 MM., AND SHEATH THICKNESS 0.61 MM. THE NOMINAL MASS OF ONE BUNDLE WAS 32.9 KG. HYDRIDING WAS CONSIDERED SOLVED. CENTERLINE BUNDLE RATING AT REACTOR CENTER WAS 14.5 KW/CM., AVERAGE SURFACE HEAT FLUX 145 W/CM SQUARED, NOMINAL MAXIMUM SHEATH TEMPERATURE 485 DEGREES C, NOMINAL MAXIMUM CENTERLINE TEMPERATURE UC 1120 DEGREES C, AND THE PROJECTED FIRST CORE PROTOTYPE BURN-UP WAS 229 MWH/KG U.

4. UNPROVEN BUT STUDIED POSSIBILITIES WHICH HAVE BEEN EXAMINED INCLUDE THE USE OF STAINLESS STEEL CLAD INSTEAD OF ZR-,8 CLAD, OPERATION OF THE UC FUEL AT CENTERLINE TEMPERATURES ABOVE THOSE IN THE PROPOSED PROTOTYPE, OPERATION IN CORE CONFIGURATIONS THAT WOULD PROVIDE FULL XENON OVERRIDE, MIXED UC-THC FUELS, AND DESIGN AND OPERATION AT NEAR BREEDING LEVELS.

5. ABOVE INFORMATION HAS CLEAR IMPLICATION FOR BETH WORKSHOP REPORT, HOWEVER, IMPLICATIONS GO FURTHER. AECL'S WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT HAS BEEN IN A SENSE UNDERUTILIZED SINCE AECL DECLINED TO GO TO GOC FOR HWOCR PROTOTYPE FUNDING FOR POLITICAL REASONS, NOT REPEAT NOT TECHNICAL ONES.

6. BETWEEN WNRE AND CHALK RIVER FACILITIES, EXCEPTIONALLY COMPETENT UC FUEL RESEARCH TEAM REMAINS ESSENTIALLY INTACT, ALTHOUGH NEW PEOPLE HAVE BEEN ADDED OVER THE YEARS. GROUP RETAINS CAPABILITY AND HIGH STANDARDS OF ORIGINAL GROUP ESTABLISHED BY W.B. LEWIS WHICH MADE SUCH SIGNIFICANT CONTRIBUTIONS TO SAVANNAH RIVER FUEL DEVELOPMENT PROGRAM. ALTHOUGH AECL FUEL DEVELOPMENT GROUP ACTIVELY CONCERNED WITH DEVELOPMENT OF BETTER FUELS FOR CANDU SYSTEM, GROUP COULD, IN OUR VIEW, PLAY SIGNIFICANT ROLE IN EVALUATING AND PROVING FEASIBILITY URANIUM CARBIDE FUEL FOR FAST BREEDER PROGRAM.

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UM YOU WILL RECALL THAT AECL HAS SEVERAL TIMES EXPRESSED DESIRE NOT TO BECOME DEEPLY INVOLVED WITH BREEDER PROGRAM. WE HAVE REASON TO BELIEVE THAT THIS RELUCTANCE DERIVES AS MUCH FROM SHEER MAGNITUDE OF COMMITMENT WHICH WOULD BE REQUIRED AS FROM ANY INTINSIC DISAGREEMENT THAT BREEDER REACTORS MUST BE DEVELOPED IN A TIMELY MANNER. IN FACT, DESPITE W.B. LEWIS' WELL KNOWN VIEWS ON FAST BREEDERS AND HIS

DISCIPLES WHO REMAIN ACTIVE, THERE EXISTS INFLUENTIAL SENTIMENT WITHIN AECL SENIOR MANAGEMENT FAVORABLY INCLINED TO CONSIDER REASONABLE COOPERATIVE PROGRAM WHICH WOULD "GIVE CANADA PART OF THE BREEDER ACTION," E.G., PERMIT THEM TO BECOME INVOLVED IN FUEL DEVELOPMENT WITHOUT NECESSARILY HAVING TO BECOME INVOLVED IN FULL-SCALE MAJOR COMMITMENT TO WHOLE RANGE OF BREEDER-ASSOCIATED ACTIVITIES.

8. FINALLY, CANADIANS HAVE MADE A NUMBER OF SIGNIFICANT OPERATING MODIFICATIONS TO TEST RACTORS AT WNRE AND CRNL SINCE CESSATION OF AEC TESTING PROGRAMS THERE. SEVERAL OF THESE MODIFICATIONS, ESPECIALLY AT WNRE, MAKE FACILITY POTENTIALLY ADAPTABLE TO SIMULATED BREEDER FUEL TESTING PROGRAM.

9. LONG HISTORY OF MUTUALLY PROFITABLE AECL-USAEC COOPERATION PRIOR TO 1967, WHEN COMBINED WITH ABOVE FACTORS, INCLINE US TO BELIEF THAT YOU MIGHT FIND IT VERY HELPFUL IN ACHIEVING OBJECTIVES OF YOUR PROGRAM TO EXAMINE IN DEPTH CURRENT STATE OF AECL CARBIDE FUEL TECHNOLOGY AND TESTING POTENTIAL OF THEIR FACILITIES WITH AN EYE TOWARD POSSIBLY REOPENING COOPERATIVE PROGRAM AND CONCENTRATING ON CARBIDE FUELS FOR FAST BREEDER. SHOULD YOU DESIRE TO PURSUE THIS WITH AECL WE WOULD BE PLEASED TO PROVIDE YOUR STAFF WITH WHATEVER ASSISTANCE MAY BE REQUIRED IN ORDER FOR THEM TO EVALUATE THE POSSIBILITIES FOR YOU.

10. FOR DEPT: ENERGY RELATIONS WITH CANADA AS WITH OTHER COUNTRIES REMAIN EXCEEDINGLY COMPLEX AND BESET BY NUMEROUS DIFFICULTIES. IN THE EVENT THAT AEC, UPON EXAMINATION, SHOULD DESIRE TO REOPEN COOPERATIVE EFFORT WITH CANADA, WE REAMIN OF THE OPINION THAT SUCCESSFUL WORKING LEVEL COOPERATIVE PROGRAMS WHICH ARE MUTUALLY BENEFICIAL WOULD MAKE A POSITIVE CONTRIBUTION TO EASING DIFFICULTIES. IN FACT, THERE EXISTS CONSIDERABLE SENTIMENT BOTH WITHIN GOC AND KNOWLEDGEABLE OUTSIDE INSTITUTIONS IN CANDA LIMITED OFFICIAL USE

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THAT IT IS IN CANADA'S BEST INTEREST TO SUPPORT SUITABLE COOPERATIVE RESEARCH EFFORTS AIMED AT PROVIDING NEW ENERGY TECHNOLOGY FOR THE LONG-TERM FUTURE.
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